



[6450-01-P]

DEPARTMENT OF ENERGY

Interim Management of Nuclear Materials; Spent Nuclear Fuel Management at Savannah River Site

AGENCY: Office of Environmental Management, U.S. Department of Energy.

ACTION: Amended record of decision.

SUMMARY: The Department of Energy (DOE) is amending its record of decision (ROD) (published in the *Federal Register* on December 19, 1995) for the *Final Environmental Impact Statement: Interim Management of Nuclear Materials at the Savannah River Site (IMNM EIS)* (DOE/EIS-0220) and its ROD (published in the *Federal Register* on; August 7, 2000) for the *Savannah River Site Spent Nuclear Fuel Management Environmental Impact Statement (SRS SNF EIS)* (DOE/EIS-0279) with respect to management of 65 Mark-18A targets. The *IMNM EIS* evaluated the potential environmental consequences of alternatives for the disposition of a large number and variety of nuclear materials, including 65 Mark-18A targets. These targets were irradiated in a nuclear reactor at the Savannah River Site (SRS) to produce valued isotopes. The *SRS SNF EIS* evaluated the potential environmental consequences from alternatives for managing spent nuclear fuel at SRS, as well as other irradiated materials including the 65 Mark-18A targets. In both the *IMNM EIS* and *SRS SNF EIS* RODs, DOE decided to continue to store the 65 Mark-18A targets at SRS. DOE has now decided to process the 65 Mark-18A targets at SRS to recover valued isotopes in the form of solid oxides and to issue this amended ROD.

FOR FURTHER INFORMATION CONTACT: For further information on this Amended ROD, or to receive related NEPA documents, please contact: Ms. Tracy L. Williams, NEPA Compliance Officer, Savannah River Operations Office, U.S. Department of Energy, P.O. Box B, Aiken, South Carolina 29802; (803) 952-8278; or *Tracy.Williams@srs.gov*. For information on DOE's NEPA process, please contact: Mr. Brian Costner, Acting Director, Office of NEPA Policy and Compliance (GC-54), U.S. Department of Energy, 1000 Independence Avenue SW, Washington, DC 20505; (202) 586-4600; or leave a message at (800) 472-2756. This Amended ROD and related NEPA documents are available on the DOE NEPA website at *www.energy.gov/nepa*.

SUPPLEMENTARY INFORMATION:

Background

A. Mark-18A Targets and Action.

DOE has decided to process the 65 Mark-18A targets at SRS to recover the ^{244}Pu and other valued isotopes in the form of solid oxides. Processing activities at SRS will occur at the Savannah River National Laboratory (SRNL) Shielded Cells Facility (SCF) in A-Area. These oxides will be transported to Oak Ridge National Laboratory (ORNL) in Tennessee for further processing and material recovery. Processing activities at ORNL will take place in accordance with its continuing research and development (R&D) mission.

DOE manages materials containing long-lived isotopes produced from irradiating targets in nuclear reactors. A target is an object, typically a closed cylinder containing radioactive or nonradioactive material, placed within a nuclear reactor so that the material within the target may be bombarded by neutrons to produce desired isotopes.

One reactor at SRS was configured to generate a high concentration of neutrons in order to produce isotopes for defense purposes, other DOE programmatic applications, and scientific research. Eighty-six Mark-18A targets were irradiated in this reactor, producing ^{244}Pu and other isotopes including ^{252}Cf and heavy curium. Twenty-one of the 86 targets were processed at ORNL from 1971 through 1973 to recover these isotopes. The ^{244}Pu was apportioned to scientists for basic research and safeguards programs while the heavy curium was processed into targets for production of ^{252}Cf and other isotopes for medical and industrial uses. The remaining 65 targets were originally stored at SRS in the Receiving Basin for Offsite Fuels in H-Area, but are now stored in the L-Basin.

Since the 1970s the 21 irradiated and processed Mark-18A targets have provided the world's supplies of ^{244}Pu and heavy curium, and the 65 remaining targets represent the only practical source of additional supply. ^{244}Pu is a critical component of certified standards for high-precision laboratory analyses supporting nuclear forensics and nuclear non-proliferation, while heavy curium is needed as production feed for other isotopes such as ^{252}Cf . Current international supplies of both ^{244}Pu and heavy curium are nearly depleted.

To ensure the availability of ^{244}Pu and other valued isotopes, DOE will retrieve the 65 Mark-18A targets from storage in the L-Basin and process them in the SRNL SCF. The

targets will be transported to the SRNL SCF (in the SRS A-Area) in a shipping cask modified to provide enhanced shielding against neutron radiation and to accommodate the radiation spectrum of the targets (e.g., shielding using lighter elements). Each cask will contain one Mark-18A target consistent with the cask's physical and safety analysis constraints. No modifications are needed at the L-Basin to retrieve the targets.

At the SRNL SCF, the targets will be taken into shielded cells where the aluminum cladding will be chemically removed. The target material will be dissolved and the plutonium in the resulting solution separated from curium, americium, and fission products. The plutonium solution will be converted to oxide as will the solution containing the curium, americium, and fission products. Both oxides will be transported to ORNL using packaging that has been certified in accordance with U.S. Department of Transportation (DOT) and U.S. Nuclear Regulatory Commission (NRC) regulations.

These operations are similar to activities performed at the SRNL SCF from the 1960s through the 1980s to process and recover actinides, and will be performed consistent with this facility's safety analysis constraints. Minor modifications, such as installation of special handling tools and temporary shielding, will be made at the SRNL SCF to configure it to facilitate safe receipt of the modified shipping cask and transfer of the targets to the shielded cells.

Additional processing and material recovery will occur at ORNL. Processing activities will be performed in existing facilities as part of ORNL's continuing R&D mission. These ORNL mission activities are covered under an existing NEPA Categorical Exclusion determination, 3059X (June 9, 2005).

B. NEPA Reviews and Decisions.

In the *IMNM EIS*, DOE evaluated the potential impacts of alternatives for interim management of a variety of nuclear materials stored at SRS. The major categories of nuclear material considered in the *IMNM EIS* were Stable Materials, Programmatic Materials, and Candidate Materials for Stabilization (60 FR 65315; December 19, 1995):

- *Stable Materials.* Materials that were unlikely to present a safety concern over the next 10 years and were stable and suitable for continued storage. These materials included 65 Mark-18A targets containing about 1.1 kilograms of nuclear material, as well as about 380,000 discrete items including other types of irradiated targets, spent nuclear fuel, R&D material, and reactor materials such as control rods, plus about 700,000 liters (78,000 gallons) of depleted uranium solutions.
- *Programmatic Materials.* Materials that DOE needed to meet current or future program missions, mostly in a liquid form. These materials included 33,100 liters (8,900 gallons) of plutonium, americium, curium, and neptunium solutions, and 248 discrete solid items such as irradiated fuel assemblies, targets, and slugs. The 65 Mark-18A targets were also evaluated in this category.
- *Candidate Materials for Stabilization.* Materials determined to be in a physical form or storage configuration that could present a safety concern within the next 10 years. These materials included a variety of irradiated targets and nuclear fuels, and other materials including 16,000 Mark-31 targets containing 147 metric tons (160 tons) of nuclear material (primarily uranium-238 and plutonium-239

[²³⁹Pu]) and 3,450 Mark-16 and Mark-22 irradiated nuclear fuels. The total included about 22,600 discrete solid items as well as 34,000 liters (9,000 gallons) of ²³⁹Pu solutions and 228,000 liters (60,000 gallons) of enriched uranium solutions. The alternatives differed depending on the category of nuclear material. For Stable Materials, DOE evaluated a No Action (continued storage) Alternative. For Programmatic Materials, including 65 Mark-18A targets, and Candidate Materials for Stabilization, DOE evaluated a range of action alternatives. One of the action alternatives evaluated was a Processing to Oxide Alternative under which the materials would be processed to an oxide using the separations capabilities in F- and H-Canyons.

In the *IMNM EIS* ROD, DOE decided to implement the No Action Alternative for Stable Materials, including the 65 Mark-18A targets. However, DOE recognized the targets as Programmatic Materials. DOE indicated that storage would continue until “DOE makes decisions relative to their future use or disposition” (60 FR 65301; December 19, 1995), and that the Processing to Oxide Alternative as applied to americium and curium solutions could be used for “targets and slugs containing americium and curium isotopes” (60 FR 65306; December 19, 1995), a group of materials that includes the 65 Mark-18A targets.

In the *SRS SNF EIS*, DOE evaluated technologies and five broad categories of alternatives (including processing in H-Area at SRS) for the management of about 68 metric tons of heavy metal (MTHM) of aluminum-clad spent nuclear fuel, about 20 MTHM of stainless-steel or zirconium-clad spent nuclear fuel, and other nuclear materials. With respect to the 65 Mark-18A targets, the *SRS SNF EIS* evaluated the

impacts from continued storage at SRS, repackaging and shipping to another DOE site, and processing in H-Canyon at SRS with discharge to the liquid waste system and verification at DWPF. In the *SRS SNF EIS* ROD, DOE decided to continue to store the 65 Mark-18A targets at SRS.

Supplement Analysis and Summary of Impacts

In accordance with the National Environmental Policy Act (NEPA) and DOE's implementing NEPA regulations, DOE prepared the *Supplement Analysis of the Mark-18A Target Material Recovery Program at the Savannah River Site (Mark-18A SA*, DOE/EIS-0220-SA-02 and DOE/EIS-0279-SA-06, dated December 9, 2016) to evaluate whether the proposed action requires supplementing the existing *IMNM EIS* and *SRS SNF EIS*, or preparing a new EIS. The *Mark-18A SA* updates the evaluations from the *IMNM EIS* and *SRS SNF EIS* to reflect the changes in SRS facilities where the 65 Mark-18A targets will be managed, along with associated onsite transportation. The *Mark-18A SA* also evaluates the potential impacts of transporting the oxide resulting from processing the 65 Mark-18A targets to ORNL.

The *Mark-18A SA* concluded that the environmental consequences of the proposed action would be very small and would not constitute substantial changes relative to the analyses and conclusions in the *IMNM EIS* and *SRS SNF EIS*, and that there are not significant new circumstances or information relevant to environmental concerns and bearing on the action or its impacts. Therefore, no further NEPA analysis is required.

A. *IMNM EIS* and *SRS SNF EIS*.

In the *IMNM EIS*, DOE determined that any of the alternatives where the materials would be processed at the large separations facilities at SRS (i.e., F- or H-Canyon) would have larger environmental impacts than alternatives involving continued interim storage, but the potential health effects of processing alternatives would be low and well within regulatory limits. No latent cancer fatalities (LCFs) were expected for members of the public and 1 LCF was projected for workers. The potential for accidents involving the processed and stabilized materials would be reduced, and some types of accidents would no longer be possible.

The *IMNM EIS* also evaluated risks from onsite transportation of nuclear materials between SRS facilities. No radiation exposures were projected to members of the public from incident-free transport of the materials and no LCFs from radiation exposure were projected to workers. No LCFs to onsite or offsite populations or an offsite maximally exposed individual (MEI) were projected from potential transportation accidents considering a range of accidents from the very minor to the very severe.

The *IMNM EIS* determined that implementing any of the alternatives would result in little or no impacts on geologic resources, ecological resources, cultural resources, aesthetic and scenic resources, noise, or land use. Emissions of hazardous air pollutants and releases of hazardous effluents would be well within regulatory standards and existing permitting limits for the SRS facilities. None of the alternatives would result in emissions of radioactive or nonradioactive constituents resulting in disproportionate impacts on minority or low-income communities in the vicinity of SRS. Management of high-level liquid, transuranic (TRU), low-level radioactive waste (LLW), mixed

low-level radioactive waste (MLLW), and hazardous waste would be within the capacities of existing SRS waste management facilities.

The action addressed in this amended ROD will revise previously evaluated operations for the 65 Mark-18A targets evaluated in the *IMNM EIS* under the alternatives requiring processing operations at the SRS separations facilities. It will entail processing operations similar to those evaluated for tens of thousands of gallons of liquid nuclear solutions and tens of thousands of discrete solid items including the Mark-18A and Mark-31 targets and the Mark-16 and Mark-22 irradiated nuclear fuels. For example, the 1.1 kilograms of plutonium, americium, curium, and californium in the 65 Mark-18A targets represents about 7×10^{-4} percent (about 1/140,000) of the mass of the nuclear material contained in 16,000 Mark-31 targets evaluated in the *IMNM EIS* and subsequently processed in F-Canyon.

The very small quantity of material addressed by the proposed action indicates that the proposed action will have only negligible impacts and represent a negligible change to the potential environmental consequences evaluated in the *IMNM EIS*. This conclusion is supported by the *SRS SNF EIS* which evaluated the impacts from processing the 65 Mark-18A targets at H-Canyon. DOE determined that processing all 65 Mark-18A targets at H-Canyon would result in a total radiation dose to an offsite MEI of 0.0035 millirem. Byproducts of the action addressed in this amended ROD will be similar in type to the byproducts of other nuclear material processed at SRS (e.g., Mark-31 targets) and evaluated in the *SRS SNF EIS*. In the *SRS SNF EIS* ROD, DOE decided to continue to store the 65 Mark-18A targets at the L-Basin.

The *Mark-18A SA* updates the evaluations from the *IMNM EIS* and *SRS SNF EIS* to reflect the changes in SRS facilities where the 65 Mark-18A targets will be managed: (1) targets are now stored at the L-Basin (rather than the Receiving Basin for Offsite Fuels); (2) processing will occur at the SRNL SCF (rather than F- or H- Canyons); and (3) the 65 Mark-18A targets will be transported onsite from the L-Basin to the SRNL SCF. In addition, the *Mark-18A SA* evaluates the potential impacts of transporting the oxide from processing the 65 Mark-18A targets from SRS to ORNL, an activity not specifically evaluated in the *IMNM EIS* or the *SRS SNF EIS*.

B. Modifications to Previously Evaluated Activities.

Considering the operational changes that will be required for implementing the Conversion to Oxide Alternative for the Mark-18A targets (minor modifications to the SRNL SCF cells, temporary shielding, equipment removal at the end of processing), DOE re-evaluated the potential environmental consequences that could result, focusing on potential human health impacts; geologic, ecological, cultural, aesthetic, and scenic resources; noise; land use; waste generation and management; and cumulative impacts.

L-Basin Retrieval and Onsite Transportation to the SRNL SCF. Removal of the 65 Mark-18A targets from the L-Basin will involve the same routine operations as those for other targets and spent nuclear fuel assemblies. Incident-free retrieval of targets from the L-Basin and transport to the SRNL SCF would not be expected to result in radiation doses and risks to members of the public in addition to those currently experienced. In addition, it is not expected that the proposed action would introduce additional accident risks. Potential radiation exposures to transport workers are expected to be within DOE

regulations and be maintained at levels as low as reasonably achievable. Risks to workers from potential accidents will be comparable to or smaller than the risks evaluated in the *SRS SNF EIS* for onsite transfer of spent nuclear fuel. The action will not introduce additional accident risks to those evaluated in the *SRS SNF EIS*.

SRNL SCF Processing. Processing activities at SRS will occur at the SRNL SCF in A-Area rather than at F- and/or H-Canyons as evaluated in the *IMNM EIS* and *SRS SNF EIS*. Whereas F- and H-Canyons are designed to process large quantities of materials, there are only about 21 grams of ^{244}Pu in the 65 Mark-18A targets. The SRNL SCF is a more appropriate facility for performing the separations and recovery of the comparatively small quantities of materials involved.

Processing the targets will involve activities similar to those previously and currently conducted at the SRNL SCF. Operations will be performed within the SRNL safety and environmental basis, and will comply with DOE regulations, directives, and best management practices to minimize radiation exposures to workers and risks from industrial accidents or hazardous materials. Processing the 65 Mark-18A targets at the SRNL SCF will be within the scope of routine operations under its R&D mission. Although operations will vent nonradioactive volatile gases (nitrogen oxides, nitric acid, hydrogen) and fission products (krypton, xenon, iodine) through SRNL's E-wing ventilation system and the 791-A Sand filter stack, less than 100 liters of volatile compounds will be vented per target (6,500 liters total over a period of nine years). Releases of both nonradioactive volatile gases and fission products will be well below levels of potential regulatory or procedural impact. Releases of fission products will be within the facility operating basis of 0.1 millirem per year (a procedural guideline to

monitor SRNL activities) and no additional sampling or approval from the South Carolina Department of Health and Environmental Control will be required. Therefore, minimal impacts to members of the public or to noninvolved workers are expected from processing the 65 Mark-18A targets. Including Mark-18A target processing, operations at the SRNL SCF will be conducted so radioactive and nonradioactive emissions from all activities will be within its existing basis of operations and the requirements for protection of the public under the National Emission Standards for Hazardous Air Pollutants.

Offsite Transportation. Oxides recovered at the SRNL SCF will be prepared for transport to ORNL using packaging that has been certified in accordance with DOT and NRC regulations. All activities will be compliant with Federal regulations and DOE directives. DOE anticipates making approximately 65 shipments using Type A packaging (e.g., Type S300 special form configuration) for the americium/curium/fission product oxides and approximately 8 shipments using Type B packaging (e.g., Type 9975 or Type 9977) for the plutonium oxides. These Type A and Type B packages are approved for much larger quantities of radioactive materials than those projected for each shipment.

DOE evaluated the potential impacts to transport crews and members of the public by scaling the analysis in the *SRS SNF EIS* for 1,400 shipments of spent nuclear fuel from SRS to a geologic repository, considering the smaller number of expected shipments to ORNL (nominally 65 shipments of americium/curium/fission products and nominally 8 shipments of plutonium oxide), and risk factors appropriate for the populations along the evaluated transport route to ORNL. No LCFs (0.0015 calculated) are expected among transport crews or the general population (0.004 calculated) during incident-free

transport. The risk of an LCF to the general population considering the range of potential accidents, from minor to severe, was determined to be about 6×10^{-7} (one chance of a fatal cancer in about 1.7 million) from all transport of the oxides, while the risk of a non-radiological accident fatality was determined to be 0.007 (1 chance in 140 of a fatality).

Other Resource Areas. Under this decision, only minor modifications will occur within the existing SRNL SCF building (modifications to the SRNL SCF cells, temporary shielding, and equipment removal at the end of processing) in an industrialized portion of SRS, and operations will entail activities at existing facilities that are similar to those previously and currently conducted at SRS. Thus, there will be no change in land use and no impacts on soil and geology, or on visual, ecological, or cultural resources. There will be no discernible increase in noise above current levels. There will be no need for additional personnel, resulting in minimal socioeconomic impacts, and no change in impacts on infrastructure (e.g., utilities), surface water resources, or groundwater resources from operation of the L-Basin and the SRNL SCF.

Wastes will be generated primarily during operations at the SRNL SCF and will include laboratory samples, scrap, and contaminated equipment such as pipettes or gloves. These wastes will primarily consist of solid or liquid LLW, MLLW, and TRU waste that will be managed within the capacities of existing SRS waste management operations. Solid LLW will be disposed of onsite in E-Area, while MLLW will be shipped offsite for treatment and disposal in accordance with the *Final Programmatic EIS for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE/EIS-0200) and amended ROD (65 FR 10061; February 25, 2000). Liquid waste will be discarded to the SRNL liquid radioactive waste system, or combined with an absorbent for disposal as

LLW or management as MLLW. TRU waste will be stored on-site in the SRS E-Area Solid Waste Facility until shipped to the Waste Isolation Pilot Plant for disposal.

Cumulative Impacts. The action addressed in this amended ROD will require activities at existing SRS facilities that are the same as or comparable to past and present operations at these facilities. Therefore, the action addressed in this amended ROD is not expected to result in increases to the ranges of cumulative impacts evaluated in the *IMNM EIS* and *SRS SNF EIS*.

C. Supplement Analysis Conclusion.

The action addressed in this amended ROD will revise the management approach for a very small fraction of the materials evaluated in the *IMNM EIS* and *SRS SNF EIS*. The operational changes at SRS that will be required for implementing the action are expected to have only minor environmental consequences.

Environmentally Preferable Alternative

In the *IMNM EIS* and *IMNM EIS* RODs, DOE determined that any of the alternatives involving continued interim storage would have smaller environmental impacts than alternatives involving processing at the large separations facilities at SRS (e.g., F- or H-Canyon) while the processing operations were underway. Of the evaluated processing alternatives, the environmentally preferable alternative identified in the *IMNM EIS* ROD for targets containing americium and curium was Processing and Storage for Nitrification. This remains the environmentally preferred alternative.

The action addressed in this amended ROD does not involve processing operations at large separations facilities at SRS. The action addressed in this amended ROD will result in increased but small levels of short-term environmental impacts from target recovery, onsite transfer, and processing to recover desired isotopes, and transport of the recovered isotopes to ORNL.

Amended Decision

To enable recovery of ^{244}Pu and other valued isotopes, DOE has decided to process the 65 Mark-18A targets stored in the L-Basin. The 65 Mark-18A targets will be removed from the L-Basin and transferred to the SRNL SCF within a modified spent nuclear fuel cask. At the SRNL SCF, the targets will be processed to recover desired isotopes in two solid streams: a plutonium oxide stream and an oxide stream containing americium, heavy curium, and fission products. Minor modifications will be made within the SRNL SCF to enable efficient receipt and processing of the targets. The two oxide streams will be packaged and transported to ORNL for further processing and material recovery.

DOE expects that processing activities at SRNL could begin as early as fiscal year 2020 and would continue through fiscal year 2029 depending on how many targets can be processed per year.

Mitigation Measures

No mitigation measures were identified in the *IMNM EIS* ROD, *SRS SNF EIS* ROD, or the subsequent supplemental and amended RODs. No environmental impacts resulting from operations under this amended decision will require specific mitigation measures.

DOE will continue its current practices and policies to use all practicable means to avoid or minimize environmental harm and impacts to workers and the public when implementing the actions described in this amended ROD.

Basis for Decision

This amended decision ensures the availability of ^{244}Pu , which is a critical component of certified standards for high-precision laboratory analyses supporting nuclear forensics and nuclear nonproliferation. In addition, this amended decision ensures the availability of heavy curium for use as feedstock for production of high-demand isotopes such as ^{252}Cf , which is used in many industrial and medical research and health care applications, such as cancer treatment. Implementing this action also provides a disposition pathway for all remaining Mark-18A targets in storage at SRS.

The action addressed in this amended ROD will involve a very small fraction of the nuclear materials evaluated in the *IMNM EIS* and *SRS SNF EIS* and will entail use of an existing DOE facility performing activities similar to those previously conducted at SRS and within the scope of the facility's R&D mission. The action addressed in this amended ROD will not result in potential health or environmental consequences that will be significantly different from the small consequences that were determined in the *IMNM EIS* and *SRS SNF EIS*.

Issued in Washington, DC, on February 27, 2018.

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Environmental Management.

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